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REVIEWS.

New Steam Tables and Diagrams.

Reviewed by WILLIAM KENT,* M. Am. Soc. M. E.

TABLES AND DIAGRAMS OF THE THERMAL PROPERTIES OF SATURATED AND SUPERHEATED STEAM.—By Lionel S. Marks, Assistant Professor of Mechanical Engineering, Harvard University, and Harvey N. Davis, Ph. D., Instructor in Physics, Harvard University. New York, London and Bombay: Longmans, Green & Co. Cloth; 6¼ × 9¼ ins.; pp. 106; 8 figures in the text and 2 folding diagrams in pocket. $1, net.

The recent investigations in Europe and in this country into the properties of saturated and superheated steam, in which electrical methods were used for the heating and for the measurement of the heat quantities, have given results so nearly approaching accuracy as to make out of date all the old steam tables based on Regnault's experiments of sixty years ago, in which the condensation method of measurement was used. New steam tables are therefore called for, and the want has just been filled by two books of tables which have appeared this year: the revised edition of Peabody's tables, and the book now before us.

Each of these books contains two tables of the properties of saturated steam, one, for every degree of temperature Fahrenheit up to 428 in Peabody's tables, and for every degree up to 400, and every 10 degrees up to 689 in Marks and Davis's table; and the other for every pound of absolute pressure, from 1 to 336 in Peabody's table and for every pound to 250, every 2 lbs. to 300, every 10 lbs. to 500, every 25 lbs. to 600, in Marks and Davis' table. The Marks and Davis tables contain three columns more than the Peabody tables, viz., barometric pressure or pressure in atmospheres, total heat of steam, and total entropy, including the entropy of the water and of the evaporation, which are omitted in Peabody's tables.

The principal difference between the two books may be summarized as follows: Peabody gives a temperature-entropy table occupying 52 pages. This table includes (besides the temperature and the entropy), the pressure, the quality, as related to moisture and to superheat, the heat contents, and the specific volume. The greater part of the Marks and Davis book is a 44-page table of saturated and superheated steam, for each pound pressure up to 250 lbs., for each 5 lbs. up to 310 lbs., each 10 lbs. to 400 and each 50 lbs. to 600. This table gives the temperature, volume, total heat, and entropy of both water and steam for every ten degrees of superheat from zero up to 200, and also for 250, 300, 350, 400, 500 and 600 degrees of superheating.

A short table is also given by Marks and Davis by which the increase in total heat and in entropy for steam superheated from 600 to 2,000° superheat, may easily be calculated. Another table gives thermal properties of water at saturation pressure for every 10° from 20° up to 670°. The last 40 pages of the book is devoted to an explanation of the use of the two charts or diagrams of curves which are printed on large folding sheets, and a discussion of the sources from which all of the tables were derived.

The authors have made a very thorough study of all the recent researches on the properties of steam, and they give their reasons for selecting the basic figures used in the calculations. They take as the fundamental definition of the British Thermal Unit, the average quantity of heat required to raise the temperature of water 1° F., between 32°, and 212°, or in other words, 1/180 of the heat required to raise 1 lb. of water from 32 to 212° F. In this they differ from Peabody, who defines the heat unit as the quantity of heat required to raise the temperature of 1 lb. of water from 62 to 63° F. The difference is not important in most engineering calculations, being but three parts in 1,800, or 1/600; that is, Peabody's table gives 180.3 as the heat required to raise the temperature of 1 lb. of water from 32 to 212° F. while Marks and Davis give 180.0.

The following table shows some of the differences of the figures given by Marks and Davis, and by Peabody:

Temp. F.	32°	62°	212°	300°	400°
B. T. U. in water:					
M. & D.	0	30.08	180.00	269.6	374.1
P.	0	30.1	180.3	269.8	373.1
Latent heat of steam:					
M. & D.	1073.4	1057.2	970.4	909.5	827.2
P.	1071.7	1056.0	969.7	908.9	827.9
Pressure:					
M. & D.	0.0886	0.2749	14.70	67.00	247.1
P.	0.0886	0.2750	14.698	66.98	246.9
Density, lbs. per cu. ft.:					
M. & D.	0.000304	0.000885	0.03732	0.1547	0.534
P.	0.000302	0.000887	0.03734	0.1547	0.535
Entropy of evaporation:					
M. & D.	2.1832	2.0258	1.447	1.1972	0.9623
P.	2.1804	2.0249	1.4441	1.1967	0.9633

The two folded sheets, already mentioned, contain the Mollier total heat-entropy diagram for saturated and superheated steam and a total heat-pressure diagram. Each diagram contains four sets of lines or curves, of constant entropy, total heat, pressure, and quality, in the first diagram, and constant pressure, total heat, specific volume, and quality, in the second.

The authors say that a diagram in which the total heat of steam is one of the coordinates is more useful and convenient for the solution of many problems of common occurrence than either the pressure-volume, or the temperature-entropy diagram. In flow-of-steam problems, a total heat-entropy diagram is greatly superior to a temperature-entropy diagram. In many cases the use of the diagram is more convenient than the use of the tables.

The figures in the tables are printed from a special black-faced type which is very easily read. The presswork is admirable. The book is commendable in every respect, and it will prove an ifivaluable companion to those who have to make accurate computations in which the properties of steam are involved.

Our attention has been called to an unfortunate oversight in connection with our review of "The Sanitation, Water Supply and Sewage Disposal of Country Houses," by Mr. William Paul Gerhard, which appeared in our issue of June 17, 1909. It was stated in the review that the book "contains little or nothing on plumbing." The facts are that in the section on "Country Houses," pages 49 to 62 take up service pipes, plumbing work, arrangement of bathrooms, soil pipes, waste pipes and traps, arrangement of supply pipes, water tanks, plumbing fixtures, sink, washtubs, bathtub, wash-basin, water-closet, and sewerage. In addition there are four pages on the care of plumbing work, in the same section.

World-Wide Reminiscences of an Engineer.

THE ADVENTURES OF A CIVIL ENGINEER.—Fifty Years on Five Continents. By C. O. Burge, M. Inst. C. E. London, England: Alston Rivers, Ltd. Cloth; 5½ × 8¾ ins.; pp. 320; eight plates. 7s. 6..d., net; American price, $3.

The time is fast passing when the engineer feels called upon to leave his home and journey into the far places of the earth to take up the work of construction, for few frontiers are left in these days, and with some exceptions every community can produce local engineers competent for any work. In the past, however, the engineer's field was the wide world, and an acquaintance with the lands that border the seven seas was accounted the necessary beginning, at least, to the engineer's career. The experiences and adventures of those men who during the past half-century have played the part of the pioneer engineer should be part of the education of their more modern and restricted professional brothers. From the title of Mr. Burge's book and a knowledge of his career, we had expected something of this sort; a book by an engineer for the engineer's leisure hour, a recital of the difficulties and successes of work in the brush and bush, an incentive to those of us whose labors are somewhat lightened by the achievements of the past and the conveniences of the present. He, however, has viewed his task differently and has accented the second rather than the last word of his title.

Born in Ireland some 70 years ago, Mr. Burge became of age at that period when England was railroad crazy and when engineers of location and construction were commanding enormous fees. He was articled to an English engineer and for some years worked on the new railways then spreading their tracks all over the island. After the financial breakdown of the '60's he found himself stranded in Europe and accepted a position on the then primitive railways of India. From then on, his profession carried him to Spain, back to London, to South Africa, to Europe again, and finally to Australia—50 years of arduous and varied endeavor.

In all this time, with the exception of a few years in journalism in England, he was engaged in engineering work, mostly in the construction and maintenance of railways, and from time to time he has devoted more than the usual amount of space to the technical accounts of this work; but the present book has hardly any indication that the author is an engineer. In this we are disappointed, for instead of an account which might have been of peculiar interest to the profession, we find the typical chat of the traveled Englishman who has gone far and seen much, and who is constrained to set it all down in detail. Ireland in the early '50's, India of the mutiny, glimpses of a raw youth named Cecil Rhodes on his first visit to that South Africa he was afterward to mark for his own, bull-fights at Seville, New York during the mud-slinging Cleveland-Blaine campaign, gossip, puns of parliamentarians, and reminiscences—an interesting mélange, but no signs of the engineer except in a brief popular account of the pier construction on the famous Hawkesbury Bridge, in Australia, on which the author was Resident Engineer. It is clever writing and good reading, but it is the work of Burge the traveler and not of Burge the engineer.

We will, however, quote two passages where the engineer sticks out: the first for the benefit of those young engineers who even now hear the call of the far-distant places; the second, the

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last words of the book, for the general edification of the world at large—for the engineer there is no need of its repetition:

It is a curious fact that, in the civil engineering profession, if a young man once goes abroad for any considerable time he is forgotten, and loses his status at home. He is generally dependent on higher members of the profession for employment. These are fully provided with assistants, who, having been able to tide over depressions, have remained with him or others. The wanderer, therefore, must either stay abroad or, if he comes home, must seek in London each time another post beyond these isles. Such a one, therefore, rarely reaches eminence at the headquarters of the profession, which London undoubtedly is. This is perhaps natural and of course there are high positions abroad, though neither in rank nor emolument vying with those at home. But employers and the public to some extent suffer, as there is no comparison between the experience gained by an engineer who has had to deal with the much larger works, and with the victories over their difficulties in the colonies, in India, and other far-off regions, and that acquired in the construction of the comparatively insignificant undertakings at home.

But to the traveling engineer himself there are compensations. He acquires a mind charged with broad cosmopolitan ideas; he gets some conception of the fact that there are some creatures in God's earth who, if not molded in the type of John Bull, have some excellences which he does not possess; and he obtains a sort of stereoscopic view of life, seeing to some extent around it its lights and its shades and its realities, from a more comprehensive standpoint than that of the home dweller.

The second:

Many colleagues I have worked with in "subduing the earth," which scriptural command seems to me to specially apply to the work of the engineer. . . . Many I have found highly capable, many hard workers, some of them mathematical geniuses, several of infinite courage and resource, some ignorant, some lazy, a few drunkards, others crotchety and difficult to deal with; but not one have I met with who was dishonorable or corrupt.

A British Work on Strength of Materials.

Reviewed by L. J. JOHNSON,* M. Am. Soc. C. E.

STRENGTH OF MATERIALS.—By Arthur Morley, M. Inst. M. E., Professor of Mechanical Engineering in University College, Nottingham. London, New York and Bombay: Longmans, Green & Co. Cloth; 5½ ×8¾ ins.; pp. 487; 244 illustrations in the text. $2.50, net; English price, 7s. 6d., net.

The special feature of this book is the large amount of attention given to the more difficult and neglected parts of its subject, particularly some topics of special importance in machine design. No farther along than the second chapter the reader finds himself in the midst of a much more lucid and comprehensive treatment of elasticity than is common in treatises of this kind, and he is soon led on through searching discussions of topics like the strength of eccentrically-loaded long columns, rotating disks and cylinders, of hooks, rings and chain-links, of flat plates of various shapes, and of the effect of speed on the strength and stability of machines.

In the field of structural design, perhaps the most noteworthy special features are the exposition of Wilson's method for dealing with continuous beams, and the extensive use of the area of the bending-moment diagram in deflection problems, and problems in fixed and continuous beams. Wilson's method may well prove a formidable rival of the Clapeyron method. Although first published a dozen years ago, it has not had the attention it deserves, and Professor Morley has done a good service in bringing it to a wider notice.

The subject matter is presented in a lucid, attractive manner, well calculated to compel the interest of even the most general student of mechanics, who, however, must not be in the least afraid of the higher mathematics. There are numerous fully worked-out numerical examples which are always so valuable to steady and encourage the worker in a new subject. Moreover, there are upwards of two hundred well selected problems of so immediately practical a nature as not only to serve the ordinary purpose of practice problems, but also to excite and maintain the enthusiasm of students for what might under less skilful treatment seem a pretty dull and profitless field of study. They show most convincingly that it is all worth while.

It is gratifying to see the frankness and care with which the author keeps the nature of the underlying assumptions to the fore.

One finds little ground for adverse criticism. It may, however, be said that, considering how much attention is given to the more out-of-the-way topics, it is something of a pity that straight beams loaded in other than a plane of symmetry of the beam's cross-section get no attention at all, and that the circle of stress is not given a hearing at least along with, if not to the exclusion of, the classic but clumsy ellipse of stress which has held the boards for so much too long already. In both these points it must be admitted that the author has committed no new fault, but has simply followed the usual practice of English-speaking writers. One could wish, too, for a little firmer handling of the nomenclature of the units in which some of the quantities like moments of inertia of plane areas are expressed. Several fine opportunities are missed for appealing to the dimension principle as an aid in interpreting formulas numerically. But here again we are criticising faults of wide prevalence and not faults peculiar to this author.

It must not be assumed from what has been said about the emphasis the book places on the more remote subjects that usual ones have been slighted, for, with the slight exceptions above stated, they have not. The book is of generous size and there is room for the staple as well as the unusual, and with reasonable intelligence on the part of the reader there should be no failure to get a correct idea of the relative importance of the topics treated.

In a word, the book must be considered an excellent piece of work. Few there are, even among those already skilled in Strength of Materials, who would not find a careful reading of this book an invigorating and profitable experience.

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DIE WASSERVERSORGUNG WIESBADENS.—By Director Halbertsma and Chief Engineer Spieser. Part of "Die Oeffentliche Gesundheitspflege Wiesbadens." Wiesbaden, Germany: J. F. Bergmann. Paper; 6 x 9¼ ins.; pp. 41; 20 plates.

Wiesbaden has an exceptionally individual water-supply system. For nearly 40 years the city has developed the underground water resources of its neighboring hill-country by infiltration galleries and deep-lying catchment tunnels. But as this source was finally outgrown, in spite of the ingenious device of storing water in the soil itself to equalize supply and demand, they had to drill wells in the bottom-lands. High bacterial content led to putting in an ozone plant for sterilizing this supply; later it was discovered, however, that watchful operation would ensure getting pure water from the wells, and therefore the ozone plant is now "in reserve." The entire system is amply worth detailed study, for which the present pamphlet offers a condensed but excellent text and illustration. Incidentally, this is a reprint of one chapter of a memorial write-up of Wiesbaden's institutions and public works, gotten out by the city. Another of its ten chapers deals with the sewerage and refuse disposal.

HOW TO USE SLIDE RULES.—By D. Petri-Palmedo. Second revised edition. New York: Kolesch & Co. Flexible Cloth; 4 x 6¾ ins.; pp. 65; 33 illustrations in the text. 50 cts.

For those who want a guide to the use of the slide-rule the little manual of Mr. Petri-Palmedo will serve as well as any that we have seen, and better than many. It is a fact that most users of the rule exploit hardly more than half the capacity of this useful instrument. Study of such a text as the present will suggest many uses that are not ordinarily thought of. There is the further value in the booklet that it briefly describes two of the modified scale arrangements of which recent years have been rather prolific, and one of them, in which the pairs of scales extend from 1 to $\sqrt{3}$ and from $\sqrt{3}$ to 10 respectively, is of considerable utility, giving in effect a 20-in. rule on the 10-in. length. The booklet has somewhat of a trade-publication aspect, however, through price lists of rules appended to the text.

EIN NEUES SCHNELLBAHN SYSTEM.—Vorschläge zur Verbesserung des Personen-Verkehrs. By August Scherl. Berlin, Germany. The Author. Cloth; 13¾ x 11¼ ins.; pp. 122; 3 plates and 52 text illustrations.

Through trains at 125 mi. per hr. and how to get them—that is the central phase of the author's speculations. Of course he uses a monorail system, in this case with gyroscopes. One of his shrewd schemes is running railways through cities on tall viaducts a hundred feet up in the air, over the house-tops, and in the open country on high embankment between retaining walls. His ideas throughout have some little germ of reason, and some of his ideals, or ultimate objects, are valid enough. These, however, are ideals also of every railway man, and in his brain they have their proper place. Why should a layman stray so far as to let his fancy run wild in devising utopian railway systems? Or why, if his fancy does run wild, should he spread his imaginings before the world? Mr. Scherl's book with its flamboyant cover and expensive perspective drawings is an object-lesson. "Schuster bleib bei deinem Leisten!"

COMPRESSED AIR WORK AND DIVING.—A Handbook for Engineers, Comprising Deep Water Diving and the Use of Compressed Air for Sinking Caissons and Cylinders and for Driving Subaqueous Tunnels. By G. W. M. Boycott, Assoc. M. Inst. C. E. London, England: Crosby Lockwood & Son. New York: D. Van Nostrand Co. Cloth; 6¼ x 10 ins.; pp. 111. With numerous plates and other illustrations. $4, net.

Had the author confined himself to diving, and kept free from caisson and tunnel work, his work would have been of greater value, we think. There is little available on diving work, including in this term both helmet diving and diving-bell or suspended-caisson work. What he writes on these matters is highly fragmentary, and in part too diffuse. The chapters dealing with caisson work, shaft-sinking, compressed-air pier foundation, and compressed-air tunneling are by no means up to the engineer's requirements in the way of a treatise or manual. Much of them, of course, has descriptive value, but not enough to justify its existence. On the whole, the book awakens a strong hope for complete revision and improvement in a second edition.

INDUSTRIAL DISTRICTS: 1905.—Manufactures and Population. Bulletin 101, Bureau of the Census, Washington, D. C., U. S. Department of Commerce and Labor. Paper; 9 x 12 ins.; pp. 81.

The boundaries of many, if not most, important cities are due to what might be termed accidents of nature or incidents of early settlement and growth. Such boundaries usually have little or no relation to the real life and activities of the city, which frequently reach far beyond the city line and include many of the surrounding municipalities. In recognition of this fact, and in order to throw some light upon the nature and extent of the industries of some of the great industrial centers of the country, the Bureau of the Census has here brought together statistics of area, population and manufactures for 13 of the most important industrial centers of the United States. The figures are recompilations from the census of 1900 and special census of manufactures taken in 1904.

The industrial center of New York includes a total area of 702 square miles, on which there was a population in 1905 of approximately 5,300,000. Next in rank come Chicago, Philadelphia and Boston, with populations of about 1,815,000, 1,538,000 and 1,250,000, respectively (in 1900), and areas of about 500 square miles each. The third industrial center group includes St. Louis, Pittsburg-Allegheny, Baltimore, Cincinnati, San Francisco, Cleveland, Buffalo and Minneapolis-St. Paul. The 13th and smallest district in the group is Providence, with 345,000 population in 1905 and an area of 154 square miles.

The bulletin contains some cost tables of statistics for each of these centers, with details for many of the subdistricts. The tables show populations, number of establishments, capital employed, number and total salaries of officials, clerks, etc., average number and total wages of wage-earners, miscellaneous expenses, cost of materials, value of products, and population of the respective districts, with percentages of increase under each head. Supplementary tables take up some of the leading industries by groups. Text for each industrial center brings out in readable form the salient features of the industries of each center.

Obviously, it is not easy to fix the boundaries of these industrial centers. The Census Bureau,

we think, has done wisely in choosing compact areas, the minor political units of which are for the most part closely related to the major unit. In order to show the wider relationships of tributary industrial areas, the Census has gone considerably further afield and given limited summaries for much larger areas than those already noted. Thus, for New York, an additional area of 2,752 square miles is taken into account, including a population of 584,000.

A New Text-Book in Physics.

LIGHT AND SOUND.—A Text-Book for Colleges and Technical Schools. By William S. Franklin and Barry Macnutt. New York: The Macmillan Co. London, England: Macmillan & Co., Ltd. Cloth; 5⅛ × 8¼ ins.; pp. 344; numerous illustrations in the text. $1.60, net.

The younger sort of readers may be impressed, in reading the third paragraph in the preface of this book, with the great boon which the authors feel that they are conferring on the educational world:

> The proper development of science cannot, however, be hoped for solely on the basis of a complete appreciation of the results of scientific research. It must be founded to some extent upon and grow out of a simple living interest in science on the part of all plain people, and the authors of this series of elementary texts on physics believe that they are doing as much for the ultimate development of science in America as any of our research specialists in physics.

A mature reader, however, shies at such an unblushing confession of ability and achievement and wonders into what sort of self-hypnosis the authors have drifted. From the preface a brilliant "popular" treatise on light and sound might be expected, but even then the authors are not the first to conceive of the usefulness of such books. An expectant glance at the interior architecture of this ambitious work shows that it is hardly "popular." There is left, then, only the conclusion that it must be for academic students generally.

The book opens up with a general discussion of the physiological sensations, "light" and "sound," and of those nerve stimuli that produce such mental sensations. Old and new theories of light and sound are very briefly stated, but no attempt is made here to justify either the new or the old. After this the historical determinations of the velocity of travel of sound and light are described.

The authors then proceed to "introduce" the student to wave actions. Academic niceties would demand, perhaps, use of the term "plunge" as more apt. This plunge is provided, too, in spite of common knowledge that the academic student is peculiarly adverse to such sudden transitions.

To show the novice what wave-shape is the authors ask him to conceive of a wire of mass "m, per cm.," under a tension "T," and drawn at a velocity, "V cm. per sec." past a point of reference and through an irregularly bent frictionless tube. While the student is considering a diagram of this supposed case, he is told that if the velocity satisfies the equation,

$$V = \sqrt{\frac{T}{m}},$$

then the moving wire would retain its bent shape, if the bent tube could be removed. For real proof of this non-evident fact, the student is referred to the authors' "Elements of Mechanics" and "Mechanics" and is then obliged to return to this book to complete the demonstration. By the time the young investigator of natural science has finished this mathematical digression, one may well take it for granted that he has forgotten that the authors intended merely to show him a simple picture of what a wave is. For engineering students who have some knowledge of mechanics, this explanation has great possibilities, but even then it should be better stated and a couple of unnecessary complications should be cut out. In making the recommended mathematical excursion, noted above, it is found that this chapter is taken with slight changes from the authors' earlier book "Elements of Mechanics," the peculiarities of which were noted in Engineering News, Sept. 12, 1907.

Following the first concept of wave action, are analogies of the non-interference and reflection of sound and light vibrations, in the actions of simple water bodies and surfaces. These are good and indeed should be intelligible to a thoughtful student, academic or scientific.

Discussions are continued on waves in general. Huygen's principle, that each and every point in a wave front may be considered as a center of disturbance from which a spherical wavelet emanates, is well stated. It is shown how the envelope of all such wavelets gives the resultant wavefront from the original disturbance. This principle is very effectively used to explain the various reflection and refraction phenomena, of plain and spherical-front waves, from or through plane and spherical surfaces.

The first section dealing exclusively with light is Chapter IV., on "Lenses and Lens Systems." Simple lenses and their properties and characteristics are first described with their applications to certain optical instruments. In describing telescopes, microscopes, etc., the objects and their images are shown, in diagrams, connected by lines drawn from the extremities of the object through the center of the object lens to the extremities of the image. For the uninitiated, the result is a simple but not a clear presentation of the action of the instruments, but for the further advanced student the omission of lines showing the extreme rays is a desirable simplification. This criticism stands, then, only on the supposition, from the preface, that it really is the uninitiated or the "plain" whom the authors especially desire to help with this text.

Next the authors describe historical examples of the development of lens systems that correct for various aberrations. The theory of lens systems is here stated piecemeal and is demonstrated in part in an appendix. This addition is entertaining and instructive for advanced students only.

The section on photometry and illumination is good, for the authors succeed, at the start, in giving the student a true idea of "candle-power" "lux" and "candle-feet"—of light and illumination. He is led around the unfortunately common idea that "candle-power expresses intensity of source" and is shown rather that it is a measure of light-shedding power or illuminating ability. The authors state that candle-power is a measure of "conical intensity," meaning by that, the amount of light sent out in a unit solid angle. This chapter is taken from an earlier text on electrical engineering in which one of the authors of this book was interested.

The section on sound is preceded by a page bearing a note that "this section has been abbreviated to the utmost, and discussion is limited to those things which are of practical importance." That is, all matters of reflection, refractors, absorption, etc., are subordinated to the generation and reception of sound impulses.

The most interesting chapter in this section of the book is "The Physical Theory of Music." Here are stated the relations of frequency of vibrations necessary to establish consonance tones and chords and for harmony and melody generally. This is a section which perhaps needs presentation, for most students, through a good instructor, but thus assisted they may be expected to readily grasp the physical basis of modern music as here exposed.

The authors have an interesting appendix on "Radiation." This is largely descriptive, or expository, and gives simple concepts of Stefan's and Wien's laws, of radiation and absorption by "black bodies," selective radiation and reflection, etc.

This review cannot be concluded without stating that there are minor faults, very minor ones some will contend, but certainly not conducive to efficient or connected study by the student. For instance, take the frequent use of some technical expression, with a foot-note reference advising the reader to examine some article several pages in advance of him, for the meaning.

The book, as a whole, leaves a critical reader in a quandary as to its probable field of usefulness. It is obviously a little above "the plain people" and a bit too technical for high-school use. As a whole, it is not an improvement over existing texts in the hands of university classes. Yet throughout are sections of striking originality, of freshness in treatment and viewpoint that should not be lost. It will be valuable to the university instructor for use in connection with present accepted works. He may accept the parts that appeal to him and pass them out, in turn, to his students. The book is therefore recommended to all college professors and instructors, interested in the teaching of physics, for their own study desks but not for class distribution.

NOTES ON EXPLOSIVE MINE GASES AND DUSTS.—With special reference to explosions in the Monongah, Darr and Naomi Coal Mines. By R. T. Chamberlin. Bulletin 383, U. S. Geological Survey; George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 68; one illustration and 24 tables.

Studies of mine gas or air samples, coal dusts and coal samples, individually and jointly undertaken immediately after three terrible disasters in American coal mines, are reported in this bulletin. These investigations were undertaken as a part of the work of the Geological Survey in preventing mine disasters and in reducing loss of life in coal mines.

The most interesting and illuminating studies were on coal dust, to discover the yield of gas and to explain the peculiar coking or charring of dust in these mines. It was hoped to find new evidence of the part played. It was found that the uncharred coal dust in workings shielded from full effects of explosions and dust made out of coal from working faces were much higher in "volatile hydrocarbons" than the coked coal dust found where the effects of the flames and explosions were most marked.

In workings where much shale dust was found mixed with the purer coal dusts, no coking of the dusts was found. This led to a few studies of the effect of shale dusts as diluents of the combustible and absorbants of the heat of an explosive flame.

While generalizations and specific conclusions have been made very cautiously in this bulletin, the reader will find much in all these studies to confirm an opinion that coal dust has but a secondary, though a very important, part in a mine explosion. The dust itself, one may well believe, is not directly burned but gives off combustible gases by the distilling action of the combustion (explosion) of gases which may have accumulated in the workings. These distilled gases of course feed the explosive flame and add to the extent and duration of the trouble. The proper addition of clay and shale dusts, whitewash, etc., it is intimated, prevents to a large extent this increase and spread of the explosion, though it has no effect on the primary accumulation of gas.

ROSE POLYTECHNIC INSTITUTE.—Memorial Volume, Embracing a History of the Institute, a Sketch of the Founder, together with a Biographical Dictionary and Other Matters of Interest. Terre Haute, Ind.: The Institute. Cloth; 5½ × 9 ins.; pp. 269; folding and other plates.

Like most of the histories of the many noted American technical schools, this book is interesting reading to students of engineering education. There is a history of the foundation of the school and a review of its past work and present activities. There are biographical sketches of the founder, Chauncy Rose, of the early presidents, the several managers, and of all the alumni.

CORPORATION COMMISSION OF THE STATE OF OKLAHOMA.—Report for the year 1908. Guthrie: The Commission. Cloth; 7 × 10¼ ins.; pp. 741; 41 illustrations.

It requires a volume of no less size than is indicated above to set forth the large amount of tabulated and other matter comprising the first report of the Corporation Commission of the new and progressive state of Oklahoma. The commission was established in accordance with a constitutional provision, which, together with so-called vitalizing legislation, is reprinted in

this volume. The commission was given jurisdiction over all transportation and transmission companies, which seems to include practically every public-service corporation in the state.

Electrical Books.

Reviewed by HENRY H. NORRIS.*

DIE FORTSCHRITTE AUF DEM GEBIETE DER ELEKTRISCHEN FERNBAHNEN.—Erfahrungen und Aussichten auf Grund von Betriebsergernissen. By O. C. Roedder. Wiesbaden, Germany: C. W. Kriedel. Stiff paper; 7¼ × 10¾ ins.; pp. 323; 172 illustrations, mostly in the text. 12.60 marks; American price, $5.

PRACTICAL ALTERNATING CURRENTS AND ALTERNATING CURRENT TESTING.—By Charles F. Smith, M. Inst. E. E., Assoc. M. Inst. C. E. Third edition, revised and enlarged. Manchester, England: The Scientific Publishing Co. Cloth; 5½ × 8¾ ins.; pp. 455; 236 illustrations in the text. 6s., net; American price, $2.40.

THE DESIGN AND CONSTRUCTION OF INDUCTION COILS.—By A. Frederick Collins. New York. Munn & Co. Cloth; 5¾ × 9¼ ins.; pp. 272; 160 illustrations, mostly in the text, and 123 tables. $3, net.

Heavy electric railroading presents the latest, as well as the most difficult problems which have confronted the electrical engineer. Light urban, suburban and interurban conditions are now thoroughly understood and practice is fairly well standardized. This is far from being the case with steam-railway electrification. A few roads employ electric locomotives on a small scale and in a very few cases large numbers are used. At the same time the directors of many, if not all, of the steam railroads are studying the possibilities of electric operation. Surprises are now the order of the day, as one road after another adopts electricity for some special purpose. Two distinct systems, the direct current and the alternating current, are in use and the advocates of each believe that ultimately it will prove its superiority. The New Haven road has recently decided to greatly extend its range of electrical operation in which alternating-current motors are used. On the other hand, the Pennsylvania Railroad has adopted direct-current motors for its New York terminal after a careful trial of both systems. Its engineers also made a thorough study of the results of the New York Central and other partially electrified direct-current roads, as well as of the New Haven, Erie and others which had selected the alternating current. Every decision such as that of the New Haven or the Pennsylvania road assists in standardizing practice, as it is based upon a knowledge of the local requirements and of the facilities available for meeting them. The New Haven is a trunk line proposition, Boston being the goal. The New York Central and the Pennsylvania present primarily the tunnel problem and with it that of the congested terminal. From these prominent examples it would appear that the alternating-current motor presents advantages of cheapness and low operating costs, essential in the long haul. These offset the probable greater capacity and greater reliability of the direct-current motor, which are apparently the determining factors in tunnel and terminal work. It should not be assumed, however, that these conclusions are generally accepted. They are simply inferences which may be reversed without notice.

Much scattered information regarding the heavy traction situation is to be found in the technical press, but up to the present time little attempt has been made to gather it into convenient form for reference. Mr. Roedder has done this in a systematic and thorough way by compiling in tabular form a complete history of heavy electric traction to date. Accompanying the tables are descriptions of typical systems and a general discussion of the principles involved. American, as well as European practice, is covered and apparently no important installation, here or abroad, has been overlooked. Even the Pennsylvania Railroad's New York terminal is mentioned. It is classed as a probable single-phase electrification. The author's prediction, a natural one, was incorrect as, contrary to general expectation, the direct current was finally adopted. The author has freely consulted all possible sources of information and has produced the best summary of his subject yet available. The tables will be useful even to those who are not familiar with the German language and who do not care for the author's personal opinions based upon the collected data.

The book opens with a comparison of steam and electricity as the source of power for traction purposes. The advantages and disadvantages of each are taken up briefly and illustrated by diagrams and numerical data. The financial aspects of electrification are given special study. Numerous curves and tables are used to show the relation of costs to other variables, such as speed, grade, tractive effort, power, etc. Then follow sections on the different classes of service and the several varieties of equipment. The former include terminals and tunnels, interurbar and suburban service and heavy city service. Under the latter are high and low voltage direct current, single and three-phase alternating current, and combinations of these. All of the sections are replete with statements of fact and with diagrams and pictures showing the latest advances. The following translation of the most important section headings give a general idea of the contents of the book:

Part I.:

(1) Introduction.
(2) Comparison of steam and electricity as the motive power for railways (advantages and disadvantages of each).
(3) Tractive resistance and power consumption.
(4) Application of electric traction to trunk lines, to date.
(5) Classification of electric roads (a) on the basis of class of service and (b) on the basis of the variety of current employed.

Part II.—Principal railway systems:

(1) Direct current roads with moderate and with high voltages.
(2) Direct current roads with three-phase power transmission.
(3) Three-phase roads.
(4) Single-phase roads. (1) Single-phase railway motors in general; (2) varieties of single-phase motors, (a) synchronous type, (b) induction type, (c) series type with and without commutation poles, (d) repulsion type, (e) repulsion versus compensated series type; (3) equipment and system employed, (a) power transmission and arrangement of sections, (b) equipment of locomotives and motor cars.

Part III.:

(1) Synopsis of the four principal railway systems.
(2) The outlook for electric traction in different countries.

Part IV.—Tabular data of 77 important electric roads: Detailed tables of leading roads, (1) high voltage direct current roads, (2) direct current roads with three-phase transmission, (3) three-phase roads, (4) single-phase roads.

Complete indexes.

In the short time which has elapsed since the publication of the second edition of Smith's Practical Alternating Currents* the improvements made in the design and construction of electrical machines have been such as to necessitate a considerable revision of the text. This has been amplified, particularly in the chapters devoted to transformers, alternators, and induction motors. An entirely new chapter on single-phase motors has been added. In order to make room for the new material less important parts have been condensed so that the book has been but slightly increased in size. While, in the preface, the author states that the revision has been fundamental, he has in general followed the excellent plan used in the earlier editions. The subject as a whole is introduced by elementary chapters on alternating quantities, impedance, power and power factor, and the effects of capacity. Each special topic in the body of the book begins with an explanation of the elements of the machine. Then follow directions for performing a few typical experiments which illustrate its operating principles. The instructions are accompanied by diagrams of connections and are further illustrated by performance curves plotted from tests made expressly for the purpose. In a sense the text may be said to be developed about these performance curves. The student may study these curves with great profit for, being faithfully reproduced from data obtained from actual tests, they illustrate the defects as well as the virtues of the apparatus. The author interprets the curves in a suggestive manner which will lead the intelligent reader to meditate farther upon their meaning.

In planning this book Mr. Smith evidently had in mind an average student to whom he would say about as follows:

Here is a piece of standard electrical apparatus, the design, construction and operating principles of which I propose to teach you. I shall first explain by means of a few elementary diagrams the principles on which the machine operates. As I do this you will recall those parts of physics, mechanics and elementary mathematics which bear upon the topic in hand. We shall then apply a few tests to the machine and see how it actually operates and how nearly it performs its alleged functions. Finally we shall sit down and discuss together the curves plotted from the data which we obtain and I shall be able to see how nearly you have learned the lesson which I have tried to teach you.

In order to illustrate the method more particularly, a somewhat detailed account of the induction motor section will be of interest. The chapter contains 76 pages and 34 diagrams. It begins with an explanation of the rotating field and a geometrical proof of its constancy. The reasons for the rotation of the armature and for the production of current in the secondary circuit are given and the relation of slip to currents and torque are discussed and illustrated. The effect of magnetic leakage, the measurement of slip, the calculation of slip and the measurement of resistance complete the preliminary matter. Then follow detailed instructions for the several experiments; including no-load test, locked armature test, load tests, starting torque test, etc. Accompanying each set of instructions are charts of characteristic curves, and wherever a theoretical proof is necessary it is introduced. The circle diagram is fully explained and its relation to the curves is indicated.

The new text on single-phase motors is not in accord with the general plan, as no instructions for tests and no performance curves are given. These will presumably be added in a later edition. The statements of the theory of single-phase induction motors and of series motors are very clear.

Until within a few years the induction coil has been used only for class-room demonstration and for medical purposes. The X-ray and wireless telegraphy have changed this situation and have forced the development of the coil into a piece of commercial apparatus. The induction coil is a transformer which produces a high secondary electromotive force from an interrupted direct current sent through a primary winding. It is suitable for the transformation of small amounts of power. Wireless transmission on a commercial scale requires special high-tension transformers supplied from alternating-current circuits. Mr. Collins considers that there is a need for a convenient and complete reference book devoted entirely to the induction coil and he has tried to meet the need. He has, from his large experience in the use of such coils in wireless transmission, been able to give practical details as well as underlying principles. The data and directions are such as to enable any reader, who has some mechanical skill, to design and build his own coils. This is the purpose of the book. The style is popular and descriptive, well suited to the amateurs and young students who will form the bulk of the readers. The information will be useful to any one who requires induction coils for any purpose.

On first thought one is inclined to criticise the publication of a book devoted entirely to one special device of limited application. It is a question, however, as to how such information can otherwise be made accessible. It might possibly be included in books on transformers, but this is hardly practicable because the induction coil is so different in purpose and in construction from power and lighting transformers. Different classes of readers, also, will be interested in the two types of apparatus. It may be concluded, therefore, that the separate publication is justifiable. In this case, however, the book is too large for the subject. The volume measures 9¼ by 6¼ by 1⅝ inches and weighs over two pounds. Its dimensions are almost the same as those of Steinmetz's Transient Phenomena, reviewed in these columns July 15, 1909. The latter deals in an exhaustive manner with many of the most important electrical phenomena, the former with one comparatively insignificant detail. By abbreviating sentences, by leaving out construction details, and by using thinner paper and smaller type the material given in the volume before us could have been condensed into a quarter of its present space.

*Head Professor of Electrical Engineering, Cornell University, Ithaca, N. Y.

*Review published in this Supplement for March 15, 1906.

Notable Engineering Reports on the Water and Sewer Administration of Boston.

SPECIAL ENGINEERING INVESTIGATION OF THE WATER DEPARTMENT AND THE SEWER DIVISION OF THE STREET DEPARTMENT OF BOSTON.—Reports by Metcalf & Eddy, Consulting Engineers, to the Finance Commission of the City of Boston, forming Vol. III. of the Report of the Commission. Boston: Municipal Document. Cloth; 6 × 9 ins.; pp. 1226; diagrams and many tables.

Never before, we venture to say, has there been made such a searching engineering investigation of the organization and operation of two important departments of municipal activities as is recorded in this huge volume. The results of the investigation are presented in the form of numerous reports by the engineers named. These reports were made from time to time over a period of many months, but have been rearranged for final publication. They relate in most part to department operations of the last two years or so, but in some instances a much longer period was covered.

The Boston Finance Commission, to whom these reports were made, was created several years ago to make a thorough-going investigation of the municipal administration of Boston. Vols. I and II. of the report of the commission consist largely of various communications and reports by the commission itself covering a wide range of investigations, which included nearly every department and aspect of the city government of Boston. The net result of the work of the commission, constructively considered, was formulated in a series of proposed amendments of the Boston city charter. These amendments and the explanatory report accompanying them were outlined in an article, and also discussed editorially, in our issue of March 25, 1909. The legislation resulting was outlined briefly in our issue of July 15, 1909.

Returning to the volume before us, on which some of the most important recommendations of the finance commission were based, obviously it is impossible to give more than a general idea of the contents of these twelve hundred pages. Nearly every phase of water-works and sewerage administration in Boston, not within the jurisdiction of the Metropolitan Water and Sewerage Board, is discussed in more or less detail in the report. The organization of the local water and sewerage departments, methods pursued in letting contracts, the extensive system of doing work by day labor instead of contract which has prevailed in Boston, the information given and not given in the yearly reports of the departments, the accounting systems in vogue and various other topics are taken up. Many valuable figures relating to construction and operation costs are given and valuable comparisons are made between costs in Boston and in other cities.

Much attention is given in the various reports to the relative advantages and disadvantages of the day labor as compared with the contract system of water-works and sewerage construction—that is, the ordinary construction carried on from year to year as compared with extraordinary extensions or improvements. In this section comparative data from other cities are also given.

At the end of each of the two main sections of the volume summaries of the investigation of the water and sewer departments, respectively, and of the recommendations made for their future conduct, are given. One of the notable features of the recommendations is for a heavy reduction in working forces. Investigations showed, it may be added, that the water and sewer departments of Boston were heavily overmanned and in various ways very inefficient as compared with like departments in other cities, to say nothing of the way such work would be administered if under private instead of public control. A steady increase in the cost of doing certain classes of work and a decrease in the amount of work done per man were shown by the reports.

Some other departments than those indicated are touched upon in the volume, but it is devoted chiefly to the water and sewer departments.

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This series of reports, rearranged as they have been for purposes of publication, would repay careful and detailed study by the water and sewer departments of other cities, by municipal officials and by engineers engaged in municipal work, and in general by all thorough students of municipal affairs. The opportunity presented to the engineers who made these reports was unique, and they seized and made use of it in a way which is greatly to their credit, and will doubtless prove to be of great advantage to all who are able to secure and study their reports.

Electro-Magnetic Ore Separation.

Reviewed by JOSEPH W. RICHARDS,* M. Am. Inst. M. E.

ELECTRO-MAGNETIC ORE SEPARATION.—By C. Godfrey Gunther. New York and London: Hill Publishing Co. Cloth; 6 × 9¼ ins.; pp. 193; 81 illustrations in the text. $3, net.

This is a practical book, which purports to include only material of present commercial importance. It is a compilation, plus information gathered by correspondence, and data of the writer's own observation. The treatment of the subject matter is as follows: a brief statement of general principles, description of separators for strongly magnetic materials, of separators for feebly magnetic materials, concentration of magnetic iron ore, separation of pyrite from blende, of siderite from blende, and miscellaneous separations.

The whole impression given by the book is that it is incomplete. It discusses the physical and mechanical principles very briefly, it omits the interesting and instructive machines which have mostly gone out of use, it omits almost all laboratory and experimental results. True, the writer purposely confined the book to present commercial apparatus and processes, and as such the work is valuable. But this limitation is exactly a limitation to its value to be deplored; it teaches little, it gives little exact data for learning the principles involved, but presents these mostly as generalities. The work, therefore, is technically valuable and useful because of the carefulness with which it is compiled, but limited in its usefulness as a book of instruction or information on the subject of electro-magnetic ore separation in general.

A POCKET GLOSSARY OF ENGLISH-SPANISH SPANISH-ENGLISH TECHNICAL TERMS.—Suitable for the Engineering, Manufacturing and Mining Industries. By R. D. Monteverde, Examiner to the London County Council, Lecturer at the Birkbeck College, West Ham Technical Institute, Northern Polytechnic, etc. London, England: Crosby Lockwood & Son. (New York: D. Van Nostrand Co.) Flexible leather; 2 × 2¾ ins.; pp. 309. 2s. 6d., net; American price, $1, net.

This is a by-lingual word-index to the terms used in engineering, particularly in connection with machinery or mining. It is in very small form; in fact, so small as to be unhandy to use. Otherwise it is quite useful, as it contains many words and phrases necessary to the technical man but which are not found in the ordinary dictionary.

HISTORY OF NEW YORK SHIP YARDS.—By John H. Morrison, Author "History of American Steam Navigation." New York: The Author. Cloth; 6 × 9¼ ins.; pp. 165; 22 illustrations in the text.

From the end of the War of the Revolution to the day of the decline of the famous clipper ships of the forties and fifties New York City was the leading ship-building center of this country. An extensive water-front and cheap transportation from the northern lumber camps gave it an advantage over all other locations along the coast. But the advent of the iron hulls just previous to the Civil War shifted the scene of ship-building operations to those ports more convenient to the iron mills of the day. The New York builders were not quick enough to see the decline of the wooden ship and their trade diminished and finally died out, before they could establish a competing industry in iron hulls.

Mr. Morrison's little book is a story of this rise and fall. It has been drawn from custom house reports, contemporary history and personal recollection. It contains descriptions of all of the yards ever operated in New York and a list of most of the boats there built. Particular attention is paid to the clipper ships which brought fame to their builders and which were the climax of the sailing ship in efficiency and speed. One of these boats, the "Dreadnought," in the year 1854, made the voyage from Sandy Hook to Queenstown in 9 days and 17 hours, a creditable performance for even a steam vessel in those days, and almost beyond belief for a ship under sail.

*Professor of Metallurgy, Lehigh University, South Bethlehem, Pa.

PRACTICAL ARMATURE AND MAGNET WINDING.—A Comprehensive Treatise for the Workers, Fully Illustrating the Theoretical Principles and Shop Practice of Armature and Magnet Work. By Henry C. Horstmann and Victor H. Tousley, Authors of "Modern Wiring Diagrams and Descriptions," etc. Chicago, Ill.: Frederick J. Drake & Co. Flexible leather; 4½ × 6¾ ins.; pp. 231; 128 illustrations in the text. $1.50.

This small book is suitable for the ambitious worker who has some slight knowledge of the laws of electricity and magnetism and who wishes to know something of the application of principles to actual machinery that may come into his hands daily. Books of this class are too often carelessly written and their elucidations fail to elucidate even to the well trained. The reverse is true of this book.

Enough elementary statement of the theory of direct-current generators and motors has been included to explain the observed actions of this kind of apparatus. In this way the generation of electromotive force, the rotation of a motor armature, commutation, sparking at the armature brushes, the necessity of shifting the brushes at heavy loads, armature reaction, eddy and hysteresis losses in an armature core are all discussed.

After this, there are described several mechanical details of design that need careful attention for securing safe and efficient machines.

Armature windings are discussed at considerable length. Arnold's formula for pitch and number of coils are first stated but not proved. The applications of the formula to the common types of windings are shown with diagrams. There are given later, descriptions of shop practices in winding drum and ring armatures and in building up commutators.

At the end of the book are 64 pages on designing and building solenoids for various classes of use.

REPORT ON THE TRIANGULATION OF GREATER NEW YORK.—By the Cooperation of the City of New York and the United States Coast and Geodetic Survey. Executed 1903 to 1908. New York: Pub. Doc. (Nelson P. Lewis, Chief Engineer, Board of Estimate and Apportionment, 277 Broadway). Paper; 6½ × 10 ins.; pp. 457; text illustrations, tables, folding sheets, and two folding maps in pocket.

In 1903 the City of New York and the U. S. Coast and Geodetic Survey entered into an agreement to conduct a triangulation survey of the city, for which work the federal bureau was to furnish the supervising officers and the instruments and the city the minor engineers in addition to defraying the running expenses. This survey was completed in 1908 and the book noted above is an account of the work. It consists of two parts, the first, on the field work, by Mr. A. T. Mosman, Assistant, U. S. Coast & Geodetic Survey, who was in charge of the survey, and the second, on the computation, by Mr. John F. Hayford, Chief of the Computing Division, U. S. Coast & Geodetic Survey. These two papers are accompanied by full accounts of the methods of work and descriptions of the instruments, as well as detailed specifications of the triangulation itself. The triangulation of a city covering the great area of New York is a difficult problem the solution of which is interesting to the average engineer and useful to the one engaged in similar work.

CRAFTSMAN HOMES.—By Gustav Stickley. New York: The Craftsman Publishing Co. Cloth; 8 × 11 ins.; pp. 205; plates, and numerous text illustrations. $2.

The author has here brought together in convenient and commendable form, floor plans, perspective sketches and brief notes descriptive of a large number of designs for "Craftsman homes." These designs for the most part show relatively modest and inexpensive structures,

READY JULY 28

BRICKLAYING SYSTEM

By

Frank B. Gilbreth

Ancient as the art of bricklaying is, there has never been a *real* book on the subject before. Indeed, astonishingly little has ever been written about brick masonry, and, so far as the economics of the subject is concerned, nothing has heretofore appeared in book form. It is a large subject, and one of growing importance in spite of the advent of concrete. In fact, scores of concrete buildings are faced with brick, or have brick curtain walls.

Gilbreth's "Bricklaying System" is a book whose 330 pages are filled with rules and hints for his foremen and bricklayers, designed to increase the output of the workmen and to enable men of moderate skill to do difficult work in the best manner. There are 73 charts showing different bonds, ornamental and plain, some of which would be exceedingly hard to execute were it not for the methods explained in the text. To the architect, 73 ornamental charts alone will prove of great value, for practically none of them can be found in any other book, and no other book has more than 8 different bonds.

Among the many labor-saving devices and methods in this book, none is more worthy of comment than what Mr. Gilbreth calls his "packet system" of handling bricks. The bricks are piled on small, wooden trays or "packets," loaded onto wagons, hauled to the work and delivered to the bricklayers. This handling in units has worked a remarkable reduction in cost on Mr. Gilbreth's own work. Incidentally, by keeping tab on the number of empty "packets," the exact output of each bricklayer is recorded, which itself is a stimulus that works wonders in the output of the men.

The "fountain trowel" is another money-saving device. Space prohibits mention of more.

The book is now off the press, and, upon allowance of foreign copyrights (July 28), will be ready for distribution. Its size is 6 × 9 ins., 330 pages, 167 illustrations and 73 bond charts. The price is $3.00 net, postpaid.

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Railway Legislation and Safety Appliances in England.

THE SAFETY OF BRITISH RAILWAYS or Railway Accidents: How Caused and How Prevented.—By H. Raynar Wilson, author of "Mechanical Railway Signalling" and "Power Railway Signalling." London, England: P. S. King & Son. Cloth; 5 × 7½ ins.; pp. 240. 3s. 6d., net.

Mr. Wilson's book is rather misnamed. It should be called "Railway Legislation and Safety Appliances in England," as it is essentially a historical review of these two subjects. For an American reader interested in railway operation and safety it furnishes good reading, because there is a close parallelism of the English and American evolution, except that the former is a decade or two earlier, less complex in its underlying conditions, and more primitive in method.

The book being small, its review of the forty or fifty years' work in question is sketchy, and we may also say without disparaging Mr. Wilson that it lacks the mastery which the trained historian would bring to bear. But the vital elements shine through nevertheless. And of these none is more clearly perceived than the fact that governmental pressure, exercised as a result of and by means of the work of the Board of Trade, was the chief stimulus to the continuous improvement; and the further fact that the companies put much opposition against the efforts of the Board, some outspoken opposition and a far greater amount of silent inactivity and counter-irritation. Exactly the same unpleasant spirit which we observe so often in the attitude of American railway officials, and still more so in that of trolley-car men, appears repeatedly in the story from England. A specific illustration appears in an annual report at a stockholders' meeting, where the Board of Trade was charged with joint responsibility for railway accidents because it continuously urged the adoption of block-signaling! The railway chairman claimed that half the power to manage its property was taken away from the company and all the responsibility left there—just the same foolish charge repeatedly brought against our Railway and Public Service Commissions by arrogant but ignorant managers.

Another element of the situation as it appears from this book is the inherent complexity and unavoidable slowness of the evolution from haphazard, unsafe operation to rigidly safeguarded and systematized operation. One may see very clearly that it takes many years to reduce the accident record by 50%; but also that we have a right to look for continuous reduction, i. e., some progress every year.

The English situation differs greatly from ours in their high percentage of double-track line, their extensive use of manual blocking, their freedom from trespassers, their better roadway maintenance, and their different braking problem (small cars but on the whole rather inefficient brake systems). The influence of these matters is deducible from the author's figures and statements.

A chapter on American railway accidents, while not specially useful, shows a much better appreciation of the difficulties of our situation than is usual with English writers.

MASSACHUSETTS HIGHWAY COMMISSION.—Report for the Year Ending Nov. 30, 1908. Boston: The Commission. Cloth; 6 × 9 ins.; pp. 276.

Besides the usual interesting collection of statistical and other matter relating to state highway construction and maintenance in Massachu-

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The increasing interest in the matter of clean streets and the absence of any treatise which may serve as a guide to right principles and practices in this branch of sanitation has led to the publication of this book, which consists of notes based upon Dr. Soper's extensive personal experience in work of this kind under peculiarly difficult circumstances, and also upon studies made by him during a visit to Europe in 1907, in an advisory capacity to a commission on street cleaning for New York appointed by Mayor McClellan.

The book is profusely illustrated with views taken by the author of street conditions in different cities, and describing various devices and systems in use for the cleaning of streets and the removal and disposal of refuse. This feature of the book cannot be too highly commended.

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setts, this volume contains brief reviews of tests of various systems of constructing and treating roads for the prevention of dust and to resist wear from automobiles. The volume also contains some brief statements on roadside tree planting by the forester of the commission.

An appendix of about 100 pages of the volume is devoted to telephone matters, including annual returns of telephone companies. This feature of the report is due to the supervision of the telephone companies of the state which was delegated to the State Highway Commission by an act of the Legislature passed in 1906.

Reinforced Concrete.

PRINCIPLES OF REINFORCED-CONCRETE CONSTRUCTION.—By F. E. Turneaure, Dean of the College of Engineering, University of Wisconsin, and E. R. Maurer, Professor of Mechanics, University of Wisconsin. Second edition, revised and enlarged. New York. John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 429; 142 illustrations in the text. $3.50; English price, 15s., net.

In the review of the first edition of this book Prof. L. J. Johnson said:

> Apart from . . . points of minor detail . . . it is difficult to see how, in the present state of the art, a better and safer exposition could have been made. . . . The book will be found indispensable by all workers in reinforced-concrete design.

With the additions made necessary by the developments of the past two years, the present edition is worthy of the same commendation. It is still far and away the best book in English on the design of reinforced concrete.

It has been found necessary to change but very little in the first edition. A lower value for safe bonding stresses and a more conservative view of the hooped column are about the only divergencies.

In the additional matter, however, there is much that is new. All of the authoritative experiments of the past two years have been utilized and some reproduced, especially those on bond strength, shear in beams and hooped columns. A complete treatment of the deflection of reinforced-concrete beams is given, something novel in the literature of reinforced-concrete. Diagrams have been added in the T-beam design and the tables for floor-slabs gone over and typographically improved. Continuous beams are more thoroughly explained and diagrams for circular slabs added. The example in the design of arches has been amplified and the application of influence lines to such arches given. The entire subject of working stresses is much clearer than before and admirably presented. Finally, there has been added a chapter on the design of reinforced-concrete chimneys.

It should be remembered that the field of the book is pure design. The material itself and its construction are touched upon no more than is necessary for the explanation of the design.

It may be well to call attention to the informal use, at the top of p. 421, of only the given name of a well-known investigator in concrete, as an indication of a pleasing familiarity between co-workers in the same field.

INSTRUCTIONS TO INSPECTORS ON REINFORCED-CONCRETE CONSTRUCTION AND CONCRETE DATA.—By George P. Carver, Assoc. M. Am. Soc. C. E. Boston, Mass.: The Author (53 State St.). Stiff paper; 4¼ × 6½ ins.; pp. 107; illustrated; 50 cts.

This is a second edition of the handbook reviewed in our issue of Sept. 12, 1907, p. 295. The new edition has some additions but in the main is similar to the original. It starts with instructions to superintendents on concrete work, contains considerable data on cost and on beam design, and is completed with two papers, the one by Mr. L. H. Kunhardt on "Fire Insurance on Factories of Reinforced Concrete," the other by Mr. E. P. Goodrich on "Hints on the Design and Execution of Reinforced-Concrete Works."

THE LATIN-AMERICAN REPUBLICS.—Annual Review Number of the Bulletin of the American Republics. Washington, D. C.: International Bureau of the American Republics. Heavy paper; 6 × 9 ins.; pp. 295; numerous illustrations in the text and one inset map. Single number, 25 cts.

This issue of the monthly "Bulletin" of the International Bureau of the American Republics is devoted exclusively to a summarized statement of commercial, material and economic conditions in 20 Latin American republics (including Mexico and Cuba in addition to those in South America). A general introduction compares the conditions in the various republics and includes tables showing respective populations, railway mileages and volumes of trade for the year 1908. The special data given in the subsequent pages for each country in turn include, in each case, a brief introductory note giving general information regarding geography, topography, population and natural resources. This is followed by historical and political sketches, and these in turn by a more detailed account of present conditions including facilities for transportation and communication.

EXERCISES IN SURVEYING FOR FIELD WORK AND OFFICE WORK.—With Questions for Discussion. Intended for Use in Connection with the Author's Book, "Plane Surveying." By John Clayton Tracy, Assistant Professor of Structural Engineering, Sheffield Scientific School of Yale University. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Morocco; 4¾ × 7½ ins.; pp. 168; separate Field Note-book, 4½ × 7¼ ins. $1, net; English price, 4s. 6d., net.

In connection with his admirable text-book on plane surveying, which was reviewed in our issue of Dec. 12, 1907, p. 659, Professor Tracy has compiled a series of exercises to be used in class and in field by students who are using his text-book. The author has a theory that the study of surveying should be a gradual development with the specific study of each detail and method accompanied by field work. He thinks that the occasionally used complete-survey method is not correct, but that for the first two years at least the student of surveying should take up each subject separately. At the end of that time he may be so well versed in the rudiments of the study that he can utilize these details in a complete survey.

The exercises are very complete and in the hand of a competent instructor should prove very valuable. It is needless to say that the book is only for the use of students and not for the practitioner.

THE MOTOR CAR.—A Practical Manual for the Use of Students and Motor Car Owners. With Notes on the Internal Combustion Engine and Its Fuel. By Robert W. A. Brewer, Assoc. M. Inst. C. E., M. Inst. M. E., etc. New York: D. Van Nostrand Co. London, England: Crosby Lockwood & Son. Cloth; 5½ × 8¾ ins.; pp. 240; 55 illustrations in the text. $2, net.

Three-quarters of this book is on internal-combustion engines and auxiliaries and the remaining quarter is split up between transmission gearing, bearings, steering mechanisms, suggestions for reconstructing an antiquated automobile, for overhauling and adjusting.

A good deal of the text on the power-plant of the car is taken up by rather academic and theoretical discussions. In this way the author writes about the history of internal-combustion engines, the design of parts of stationary gas engines, thermal efficiency, engine trials, gas-producers, oil engines, vaporization of fuels,

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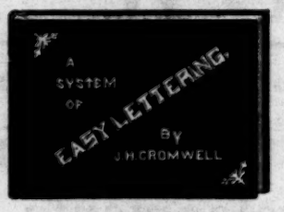

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saturation of air with combustible vapors, flow of gases and fuel oils, lubrication, etc.

The technical parts seem to have been carefully prepared, though British practice alone is treated of. The author evidently is not familiar with the trend of American automobile development, for he writes, when discussing types of petrol (gasoline) engines for automobiles:

The Americans still adhere to the horizontal type of engine; to a limited extent these are built in pairs or fours, but English firms of repute do not now make horizontal engines.

The greatest value of this book is in its presentation to interested car owners and drivers of the place of the automobile engine in the wide field of the development of internal-combustion motors.

Expert Testimony on Water Disinfection.

LEGAL TESTIMONY ON DISINFECTION OF THE JERSEY CITY WATER SUPPLY BY HYPOCHLORITE OF CALCIUM.—Testimony for Defendants in the Chancery Suit of the Mayor and Aldermen of Jersey City against the Jersey City Water Supply Co. 2 Vols. [Paterson, N. J.; The Paterson Chronicle Co.] Cloth; 7½ × 11 ins.; pp. 1078. $10 for the 2 Vols.

In Engineering News of June 24, 1909, there was published a lengthy illustrated article entitled "The 40,000,000-gal. Disinfecting Plant of the Jersey City Water Supply Co. at Boonton, N. J." This article consisted of abstracts of three papers presented to the June convention of the American Water Works Association by Dr. J. L. Leal, Sanitary Adviser of the Jersey City Water Supply Co., and Messrs. George W. Fuller, M. Am. Soc. C. E., and George A. Johnson, Assoc. M. Am. Soc. C. E., both of the latter being members of the firm of Hering & Fuller.

The plant in question was installed, as set forth in Dr. Leal's paper, to satisfy certain court requirements laid down in connection with a suit involving the fulfillment of contract of the Jersey City Water Supply Co. for the construction of works for the water-supply of Jersey City. It being deemed necessary for the purposes of the litigation in progress to establish whether or not the disinfecting plant meets the requirements of the contract for supplying pure and wholesome water to Jersey City, a large volume of testimony was taken. The volumes before us include the engineering, bacterial and chemical testimony of a large number of well-known experts, including Messrs. Rudolph Hering, George W. Fuller, George A. Johnson, Prof. William P. Mason, Prof. Leonard P. Kinnicutt, Prof. William H. Park, and many others. Analyses and many other data are given.

It goes without saying that the volumes contain a large amount of interesting and valuable matter on the treatment of water for the removal of bacteria by a process which in continued practical operation is new and has never anywhere been tried on anything like so large a scale as at Boonton. Those familiar with testimony of this sort will, of course, understand, and we say it without intending any disparagement to the experts or any one else, that to obtain a relatively small amount of valuable information they must wade through a vast mass of testimony, much of which is tiresome repetition, or otherwise inconsequential. Nevertheless, such court reports are, we believe, much valued by many engineers and other sanitarians, and especially by those who are so fortunate, or unfortunate, as to be engaged from time to time in similar litigation.

AN ELEMENTARY TREATMENT OF THE THEORY OF SPINNING TOPS AND GYROSCOPIC MOTION.—By Harold Crabtree, M. A., Assistant Master at Charterhouse. London, New York and Bombay: Longmans, Green & Co. Cloth; 6 × 9 ins.; pp. 140; 3 plates and 77 text illustrations. $1.50 net.

The theoretical explanation of gyroscopic action is very well presented in this volume. Practical applications of the gyroscope, including the monorail car and the steering device used in torpedoes, are taken as examples for analysis by the methods developed in the earlier chapters. The author has aimed to bring the subject within the range of first-year undergraduates at the universities, and has succeeded in producing a

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The Design of Yards for Classifying Freight Cars. By W. A. MacCart, Assistant to Principal Assistant Engineer, P. R. R. 26 pages, 3 illustrations.

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Tables and Data for Hailway Locating Engineers. By C. P. Howard, C. E. 24 pages, 5 figures, 3 folding plates.

No. 12.
Practical Hints for Concrete Constructors. By W. J. Douglas. 60 pages, 3 figures, 1 folding plate.

No. 13.
Trickling Sewage Filters at the Lawrence Experiment Station. By H. W. Clark. 25 pages, 2 figures, 1 folding table.

No. 14.
Expansion and Contraction in Concrete Structures. By L. F. Bellinger and A. C. Lewerens. 32 pages, 4 figures, 1 folding plate.

No. 15.
Report of the Transvaal Commission on the use of Winding Ropes, Safety Catches and Appliances in Mine Shafts. 88 pages, 8 figures, 5 folding plates.

No. 16.
Readjustment of Curves and Tangents in Maintenance of Way Work. By W. H. Wilms. 33 pages, 19 figures.

No. 17.
Some Problems in designing the Kern No. 1 Hydro-Electric Power Plant. By F. C. Finkle. 47 pages, 24 figures.

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The Detailing of Skew Portals. By J. P. Davies. 20 pages, 9 illustrations.

No. 19.
The Relation of Non-Pressure Processes of Wood Preservation to Pressure Processes. By W. F. Sherfesee. 22 pages, 9 figures.

No. 20.
Failures in Concrete Sidewalks and How to Correct Them. By L. J. Riegler. With Specifications for Portland Cement Concrete Sidewalks. 17 pages, 5 figures.

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A New Arch Curve, the Parabolic Oval. By Charles Worthington. 22 pages, 9 figures.

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PUBLIC IMPROVEMENTS FOR THE METROPOLITAN DISTRICT (Boston).—Report of the Commission on Metropolitan Improvements. [Benjamin Johnson, Chairman; Sylvester Baxter, Secretary, 14 Beacon St., Boston.] Cloth; 5¾ × 9 ins.; pp. 318; plates and maps.

A somewhat lengthy abstract of the report of this commission was printed in Engineering News of April 1, 1909. The report deals with railroads and terminals, docks, the general plan of the Metropolitan area, a new civic center for Boston and the water-front of Boston Bay. In addition, there is a section on the waterways and waterways projects of Massachusetts.

MUNICIPAL HOME RULE CHARTERS.—By Margaret Schaffner. Bulletin 18, Wisconsin Library Commission, Legislative Reference Department. Madison, Wis.: Paper, 5 × 7½ ins.; pp. 38.

A brief but interesting review of constitutional provisions for municipal home rule, so far as that is involved in the framing of city charters, is presented in this pamphlet. A few notes on procedure in charter making, and also a few references to books relating more or less specifically to the subject, are given.

Publications Received.

THE AMERICAN GAS LIGHT JOURNAL.—Devoted to the Interests of Illumination, Heating, Mechanical, Chemical and General Science. 50th Anniversary. Vol. XCI., No. 1780, July 19, 1909. In two sections; Section Two. New York: 42 Pine St. Paper; 9½ × 13½ ins.; pp. 147 to 326; illustrated. $3 per year.

ARTICULATED COMPOUND LOCOMOTIVES.—A Paper Read before the American Society of Mechanical Engineers, New York City, December, 1908. By C. J. Mellin (M. Am. Soc. M. E.), Consulting Engineer, American Locomotive Co. New York: American Locomotive Co. Paper; 9 × 6 ins.; pp. 40; 1 plate and 30 text illustrations.

BRICKLAYING SYSTEM.—By Frank B. Gilbreth, M. Am. Soc. M. E. New York and Chicago: The Myron C. Clark Publishing Co. London, England: E. & F. N. Spon, Ltd. Cloth; 6¼ × 9½ ins.; pp. 321; 171 text illustrations. $3, net.

BULLETINS, U. S. GEOLOGICAL SURVEY.—George Otis Smith, Director. (Extracts from Bulletin 379, Mineral Resources of Alaska, Report on Progress of Investigations in 1908.) Washington, D. C.: Pub. Doc. Paper; 6 × 9 ins.

379-A: General. By A. H. Brooks and C. A. Davis. Pp. 66; one plate.

379-B: Southeastern Alaska. By C. W. Wright. Pp. 67 to 86; two plates.

379-C: Prince William Sound, Kenai Peninsula, Southwestern Alaska. By U. S. Grant, D. F. Higgins, Jr., and W. W. Atwood. Pp. 87 to 152; 3 plates and 14 text figures.

379-D. Copper River Region. By F. H. Moffitt and Adolph Knopf. Pp. 153 to 180; one plate and two text figures.

379-E: Fairbanks, Yukon-Tanana and Lower Yukon Regions. By L. M. Prindle, F. J. Katz, C. C. Covert, C. E. Ellsworth, and A. G. Maddren. Pp. 181 to 266; two plates and one text figure.

379-F: Seward Peninsula. By P. S. Smith and F. F. Henshaw. Pp. 267 to 401; one plate and four text figures.

BUREAU OF LABOR STATISTICS (New York).—Annual Report for the Year Ended Sept. 30, 1907. (John Williams, Commissioner.) Albany, N. Y.: Pub. Doc. Cloth; 5¾ × 9 ins.; pp. xcvi. + 934; one diagram.

CIRCULARS, U. S. FOREST SERVICE.—Gifford Pinchot, Forester. Washington, D. C.: Pub. Doc. Paper; 6 × 9 ins.

No. 163: Paper Birch in the Northeast. By S. T. Dana, Forest Assistant. Pp. 37; 1 plate, 1 text figure and 9 tables.

No. 166: The Timber Supply of the United States. By R. S. Kellogg, Assistant Forester. Pp. 24; six text figures.

THE COLLECTION AND DISPOSAL OF MUNICIPAL WASTE.—By Wm. F. Morse, Consulting Engineer; M. Boston Soc. C. E. New York: The Municipal Journal and Engineer. Cloth; 6¼ × 9½ ins.; pp. 462; 92 text illustrations. $5, net.

COMMISSIONER OF LABOR (New York).—Annual Report for the 12 Months Ended Sept. 30, 1908. (John Williams, Commissioner.) Albany, N. Y.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 284.

COMMISSIONER OF PATENTS.—Annual Report for the Year 1908. (Edward B. Moore, Commissioner.) Washington, D. C.. Pub. Doc. Paper; 7½ × 10¾ ins.; pp. 1,035.

DISEASES OF DECIDUOUS FOREST TREES.—By Hermann von Schrenk, Formerly Expert in Charge of the Mississippi Valley Laboratory of the Bureau of Plant Industry, and Perley Spaulding, Pathologist, Investigations in Forest Pathology. Bulletin No. 149, Bureau of Plant Industry, U. S. Department of Agriculture; B. T. Galloway, Chief of Bureau. Washington, D. C.: Pub. Doc. Paper; 6 × 9¼ ins.; pp. 85; 10 plates and 11 text figures.

ELECTRIC RAILWAY TROUBLES AND HOW TO FIND THEM.—A Comprehensive Treatise on Motors, Motor Operation, Motor Repairs, Car Break-Downs, Control Systems, Repairing of Control, Air Brakes, Air Brake Troubles, and Electric Railway Operation Generally. By Paul E. Lowe, M. E. Chicago: Frederick J. Drake & Co. Cloth; 5½ × 8 ins.; pp. 367; 118 illustrations in the text. $1.50.

FACTORY INSPECTION.—(New York State Department of Labor.) Annual Report for the 12 Months Ended Sept. 30, 1907. (John Williams, Commissioner of Labor.) Also, in same volume, Annual Report of the Bureau of Mediation and Arbitration for 12 Months Ended Sept. 30, 1907. Albany, N. Y.: Pub. Doc. Cloth; 5½ × 9 ins.; pp. 282 + 603.

THE GAS PETROL, AND OIL ENGINE.—Vol. I., Thermodynamics of the Gas, Petrol and Oil Engine, together with Historical Sketch. New and revised edition. By Dugald Clerk, F. R. S., M. Inst. C. E. New York: John Wiley & Sons. Cloth; 6 × 9 ins.; pp. 380; 5 plates and 121 text illustrations. $4, net.

GEAR-CUTTING MACHINERY.—Comprising a Complete Review of Contemporary American and European Practice, Together with a Logical Classification and Explanation of the Principles Involved. By Ralph E. Flanders, Associate Editor of "Machinery," Author of "Bevel Gearing." New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¼ × 8¼ ins.; pp. 319; 219 illustrations in the text. $3; English price, 12s. 6d., net.

IST DIE MONOPOLSTELLUNG KRUPPS BERECHTIGT?—Kritische Artillerietechnische Betrachtungen. By H. v. Perbandt. Berlin, Germany: J. G. Ernst. Paper; 6 × 9 ins.; pp. 16.

THE LEAD AND ZINC PIGMENTS.—By Clifford Dyer Holley, M. S., Ph. D.; Chief Chemist Acme White Lead and Color Works. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¼ × 8¼ ins.; pp. 340; 82 illustrations. $3; English price, 12s. 6d., net.

LEITFADEN ZUM BERECHNEN UND ENTWERFEN VON LUEFTUNGS- UND HEIZUNGS-ANLAGEN.—Ein Hand- und Lehrbuch für Ingenieure und Architekten. By H. Rietschel, Professor in the Royal Technical College at Berlin. Fourth edition, revised and enlarged. Berlin, Germany: Julius Springer. Cloth; 6½ × 9¾ ins.; pp. 550; 92 illustrations in the text; 25 tables and 33 folding plates in separate volume, 6½ × 9¾ ins. 24 marks; American price, $9.60.

THE MINERAL PRODUCTION OF ILLINOIS IN 1908.—By R. S. Blatchley. Circular No. 5, Illinois State Geological Survey; H. Foster Bain, Director. Urbana, Ill.: University of Illinois. Paper; 6 × 9 ins.; pp. 20.

MINES BRANCH, CANADA DEPARTMENT OF MINES.—Eugene Haanel, Ph. D., Director. Summary Report for the Nine Months Ending Dec. 31, 1908. Ottawa, Can.: Pub. Doc. Paper; 6½ × 10 ins.; pp. 96.

MISSION FURNITURE.—How to Make It. Part I. (Popular Mechanics Handbooks, No. 1.) Chicago, Ill.. Popular Mechanics Co. Cloth; 4¾ × 7 ins.; pp. 94; numerous illustrations in the text. 25 cts.

THE NURNBERG GAS ENGINE.—By Richard Bechtel. (Read Feb. 6, 1909, before The Birmingham Association of Mechanical Engineers.) Oakengates, England: The Author (C/o The Lilleshall Co., Ltd.) Paper; 5½ × 8½ ins.; pp. 46; 33 illustrations, partly in the text, and 1 folding table.

THE PRACTICAL MANAGEMENT OF SEWAGE DISPOSAL WORKS.—A Handbook for Those in Charge. By W. C. Easdale, M. S. E., M. R. San. I. London, England: The Sanitary Publishing Co., Ltd. Cloth; 4¼ × 6¾ ins.; pp. 56. 2s., net; American price, 80 cts.

RAILROAD TERMINAL IMPROVEMENTS AT PROVIDENCE, R. I.—By George B. Francis, M. Boston Soc. C. E. The East Side Tunnel and Its Approaches, Providence, R. I.; by Edwin P. Dawley, M. Am. Soc. C. E. (Reprinted from Journal of the Association of Engineering Societies, Vol. XLII., No. 5.) Paper; 6 × 9¼ ins.; pp. 241 to 321; plates and text illustrations.

THE REPORT OF THE NATIONAL CONSERVATION COMMISSION AND A CHRONOLOGICAL HISTORY OF THE CONSERVATION MOVEMENT.—Bulletin No. 4, National Conservation Commission (Gifford Pinchot, Chairman). Washington, D. C.: The Joint Committee on Conservation (43 Wyatt Building). Paper; 6 × 9¼ ins.; pp. 52.

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